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Operation Fishbowl Roger A. Meade

After soaring “tens of miles” above Johnston Atoll atop a Nike-Hercules missile, the nuclear test designated Tightrope detonated. Tightrope was the last of five missile-borne effects tests conducted as Operation Fishbowl, a subset of the much larger Dominic test series carried out by Joint Task Force 8.¹ The missiles for the Fishbowl tests were launched from Johnston Atoll because of concerns about nuclear safety, the possibility of eye burns to native populations, and operational suitability. These concerns, particularly that of nuclear safety, proved justified when four tests failed, one with serious consequences.²

Fishbowl’s primary objective was to generate data on electromagnetic pulses (EMP), the creation and behavior of auroras, and the impact of a high altitude nuclear burst on radio communications. Previous high altitude tests (Teak, Orange, and Yucca) were not instrumented to provide such data, which was deemed critical to countering any Soviet high altitude bursts.

The first test of Fishbowl, Starfish Prime, exploded on July 9th with a yield of 1.4 megatons.³ Standing on Christmas Island, Austin McGuire witnessed the effects of the event.

At the time of the detonation, I was standing on Christmas Island, virtually on the equator, twelve hundred miles to the southeast. I saw a flash of light, presumably a reflection of some sort. Then, I saw a narrow band of blue light following the line of the earth’s magnetic field that eventually dipped down below the equator toward New Zealand. The blue light was generated by electrons emitted during the detonation. The path of the electrons was influenced by the force of the earth’s magnetic field, such that the particles circled around the magnetic field and simultaneously moved along it in a helical path. In the process of circling, the electron accelerated and thus radiated blue light. I saw the electrons reflect back and forth between New Zealand and Johnston Island in several distinct bundles until there was so much mixing that there appeared to be a blue sausage of radiation spanning the sky and looping over the western horizon. I stood in awe. We all knew that the electrons were expected to circle around the earth’s magnetic fields and then reflect when approaching the stronger magnetic field near the poles. And, since the earth’s magnetic field is not a perfect dipole shape, the electrons would eventually migrate eastward. Well, they did, presently passing directly over my head. But there is more to tell about the blue light.

¹ DOE/NV—209-Rev 16; 2015; and Frank H. Shelton, *Reflections of a Nuclear Weaponeer*, Colorado Springs: Shelton Enterprises, 11-62 through 65.

² Headquarters Air Force Special Weapons Center Air Force Systems Command Kirtland Air Force Base, New Mexico, 1961, II-1. One alternative called for launching nuclear-tipped Atlas missiles from Vandenberg AFB over areas populated by civilians. Two cases of retinal burns occurred when military personnel on Johnston Island during the Bluegill Triple Prime test.

³ The first Starfish test failed when the rocket exploded shortly after takeoff.

In the blue sausage, which was well above the earth's atmosphere, there was some sort of gross interaction among all the constituent particles that created several streams of blue light-radiating plasmas, not just one stream. These separate sausages developed kinks, wiggling in such a way to suggest that there were both attractive and repulsive forces at work. These new sausages migrated east over my head and out over the horizon. These were surely one of the most amazing things I have ever seen or will ever see.

Another interesting thing about Starfish was that the gamma rays produced by the detonation knocked electrons off their atoms of a dipole layer with both electrically positive and negative poles. Since this layer is time varying, it radiates an electromagnetic wave, or pulse, known as an electromagnetic pulse (EMP). The Starfish EMP, as measured at Honolulu, was about 20,000 volts per meter. It was enough to induce pulses of electrical current in the power distribution lines. The result was like a short circuit or downed power line. Oahu went dark for a short period of time.⁴

Checkmate followed on October 20th, having been delayed by a launchpad fire in July. Bluegill Triple Prime was successfully launched on October 26th.⁵ The final two tests, Kingfish and Tighrope, took place on November 1st and 4th respectively. Tighrope not only was the last Fishbowl test, it also was the last United States test conducted in Pacific Ocean.

Although marred by four missile failures, Fishbowl did provide Conrad Longmire of Los Alamos with the data from which he developed a theory of how high altitude EMPs are generated.⁶ However, the overall value of the Fishbowl tests to the nation's defense was, in the view of the Department of Defense, negligible. As Major General Robert Booth of the Defense Atomic Support Agency told Congress, "... there can be little doubt but that the quantity and quality of information available to the United States on high altitude nuclear effects is inadequate for the nation's military needs." Dr. Frank Shelton, a DOD technical advisor noted that "Joint Task Force 8 ... lacked the necessary experience to conduct complex missile operations in support of DOD high altitude weapons effects tests."⁷ The soon to be ratified Limited Test Ban Agreement prevented any further high altitude testing.

⁴ McGuire, Austin and Roger A. Meade, The Last Big Bang, LA-UR-16-26996, 31. Starfish Prime damaged several United States satellites as well as the Soviet satellite Cosmos V.

⁵ Three earlier Bluegill tests failed. One of these failed tests, Bluegill Prime, was destroyed on the launchpad creating both physical damage and radiological hazards.

⁶ Longmire, Conrad L., Theoretical Note 368. "Justification and Verification of High-Altitude EMP Theory, Part 1." Mission Research Corporation/Lawrence Livermore National Laboratory. June 1986, 3.

⁷ Shelton, II- 65 and 66.

Operation Fishbowl⁸				
Event	Date	Sponsors	Height of Burst	Yield
Starfish Prime	07/09/1962	LANL/DoD	250 miles	1.4 Mt
Checkmate	10/20/1962	LANL/DoD	10s of Miles	Low
Bluegill 3 Prime	10/26/1962	LANL/DoD	10s of Miles	Submegaton
Kingfish	11/01/1962	LANL/DoD	10s of Miles	Submegaton
Tightrope	11/04/1962	LANL/DoD	10s of Miles	Low

⁸ Derived from DOE-209.